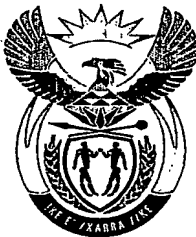


Sertifikaat

ATENTKANTOOR

REPUBLIC OF SOUTH AFRICA

EPARTEMENT VAN HANDEL
EN NYWERHEID



REPUBLIEK VAN SUID-AFRIKA

Certificate

PATENT OFFICE

DEPARTMENT OF TRADE AND
INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that

REC'D 11 DEC 2003

WIPO

PCT

the documents attached hereto are true copies of
the Forms P2, P6, provisional specification and
drawings of South African Patent Application No.
2002/8778 in the name of Element Six (Proprietary)
Limited

1B/03/3921

Filed : 30 October 2002

Entitled : Tool insert

Geteken te
S

PRETORIA

in die Republiek van Suid-Afrika, hierdie
in the Republic of South Africa, this

20th

dag van
day of

October 2003

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH
RULE 17.1(a) OR (b)

Registrateur van Patente

Dislike

APPLICATION FOR A PATENT
AND ACKNOWLEDGEMENT OF RECEIPT
(Section 30 (1) - Regulation 22)

REVENUE

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HASR 711

The granting of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate.

REPUBLIC VAN SUID AFRIKA
S & F REFERENCE

OFFICIAL APPLICATION NO.

21 01 2002/8778

PA134046/P

FULL NAME(S) OF APPLICANT(S)

71 ELEMENT SIX (PROPRIETARY) LIMITED

ADDRESS(ES) OF APPLICANT(S)

DEBID ROAD, NUFFIELD, SPRINGS, 1559, GAUTENG, SOUTH AFRICA

TITLE OF INVENTION

54 TOOL INSERT

THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2. THE EARLIEST PRIORITY CLAIM IS:

COUNTRY: NIL

NUMBER: NIL

DATE: NIL

THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO.

21 01

THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND IS BASED ON APPLICATION NO.

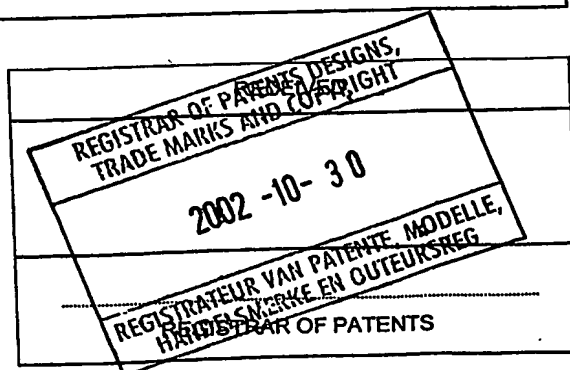
21 01

THIS APPLICATION IS ACCOMPANIED BY:

- ☒ 1. A single copy of a provisional specification of 6 pages.
- ☒ 2. Drawings of 1 sheet.
- ☐ 3. Publication particulars and abstract (Form P.8 in duplicate).
- ☐ 4. A copy of Figure of the drawings (if any) for the abstract.
- ☐ 5. Assignment of invention.
- ☐ 6. Certified priority document.
- ☐ 7. Translation of the priority document.
- ☐ 8. Assignment of priority rights.
- ☐ 9. A copy of the Form P.2 and the specification of S.A. Patent Application No.
- ☐ 10. Declaration and power of attorney on Form P.3.
- ☐ 11. Request for ante-dating on Form P.4.
- ☐ 12. Request for classification on Form P.9.
- ☒ 13. Form P.2 in duplicate.
- ☐ 14. Other.

74 ADDRESS FOR SERVICE: SPOOR & FISHER, SANDTON

Dated: 30 October 2002


 SPOOR & FISHER
 PATENT ATTORNEYS FOR THE APPLICANT(S)


REPUBLIC OF SOUTH AFRICA			REGISTER OF PATENTS			PATENTS ACT, 1978		
OFFICIAL APPLICATION			LODGING DATE: PROVISIONAL			ACCEPTANCE DATE		
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INTERNATIONAL CLASSIFICATION			LODGING DATE: COMPLETE			GRANTED DATE		
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FULL NAME(S) OF APPLICANT(S)/PATENTEE(S)								
71	ELEMENT SIX (PROPRIETARY) LIMITED							
APPLICANTS SUBSTITUTED:						DATE REGISTERED		
71								
ASSIGNEE(S)						DATE REGISTERED		
71								
FULL NAME(S) OF INVENTOR(S)								
72	1. TANK, KLAUS 2. ACHILLES, ROY DERRICK 3. CHAPMAN, RAYMOND ALBERT							
PRIORITY CLAIMED		COUNTRY		NUMBER		DATE		
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TITLE OF INVENTION								
54	TOOL INSERT							
ADDRESS OF APPLICANT(S)/PATENTEE(S)								
DEBID ROAD, NUFFIELD, SPRINGS, 1559, GAUTENG, SOUTH AFRICA								
ADDRESS FOR SERVICE						S & F REF		
74	SPOOR & FISHER, SANDTON					PA134046/P		
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61								
FRESH APPLICATION BASED ON				DATE OF ANY CHANGE				

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) – Regulation 27)

OFFICIAL APPLICATION NO.

LODGING DATE

21	01	2002/8778
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22	30 OCTOBER 2002
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FULL NAMES OF APPLICANTS

71	ELEMENT SIX (PROPRIETARY) LIMITED
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FULL NAMES OF INVENTORS

72	TANK, KLAUS ACHILLES, ROY DERRICK CHAPMAN, RAYMOND ALBERT
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TITLE OF INVENTION

54	TOOL INSERT
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BACKGROUND OF THE INVENTION

THIS invention relates to a tool insert.

The use of diamond compacts, also known as PCD, as cutting elements are well known in the art and used extensively in various cutting, drilling, milling and other abrasive operations due to the high abrasion resistant properties of diamond cutters. The diamond cutters, however, are not always suitable for all substrates encountered. For instance, it is well established that diamond cutters cannot be used satisfactorily for milling or drilling through ferrous substrates such as steel. As a result, the use of diamond cutters in certain down the hole drilling operations is not suitable as milling through a steel casing, which is used to line the vertical borehole or shaft, is required.

As PCD is not suitable for drilling through the steel casing due to reactions with the ferrous materials, an alternative drill bit insert is required. Accordingly, tungsten carbide cutters are typically used in the drill bit to mill through the steel casing. Once through the casing, the tungsten carbide inserts have to be replaced with abrasive resistant cutters such as diamond cutters in order to drill into the bedrock. This means that the drill bit has to be removed and replaced with an appropriate bit. As the drill strings that have to be removed are very long, this is a time consuming exercise that results in costly downtime.

SUMMARY OF THE INVENTION

According to one aspect of the invention, a tool insert comprises:

a substrate having an upper surface and a support ring extending away from the upper surface, the support ring being spaced inwardly from a periphery of the support surface so as to define a recess within the confines of the support ring and a shelf about the periphery of the support ring;

a layer of ultra-hard abrasive material located within the recess and bonded to the upper surface of the substrate and the inner surface of the support ring, the layer of ultra-hard abrasive material having a top surface, a portion of the periphery of the top surface of the ultra-hard abrasive material providing a primary cutting edge for the tool insert; and

a protective layer supported on the shelf and bonded to the outer surface of the support ring so as to protect the support ring and the primary cutting edge of the ultra-hard abrasive material, a periphery of the protective layer providing a secondary cutting edge for the tool insert, the depth of the protective layer being selected so as to be sufficient to protect the primary cutting edge whilst cutting, milling or drilling through a first substrate but to expose the primary cutting edge soon after encountering a second substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a sectional side view of an embodiment of a tool insert of the invention;

Figure 2 is a plan view of the tool insert of figure 2;

Figure 3 is a sectional side view of an alternative embodiment of a tool insert of the invention; and

Figure 4 is a schematic sectional side view of a rotary drill bit in a subterranean rock drilling operation.

DESCRIPTION OF EMBODIMENTS

Referring to figures 1 and 2, of the accompanying drawings, an embodiment of a tool insert of the invention is shown. The tool insert comprises a tungsten carbide substrate 10, a PCD layer 12 located within a recess 14 and surrounded by an annular section or ring 16 of the tungsten carbide substrate, and a protective layer or ring 18 surrounding the ring 16.

The ring 18 may be formed of a different grade of tungsten carbide to that of the substrate 10 or, alternatively, be formed of tool steel or other appropriate material. The choice of material is dependent on the substrate to be milled, drilled or cut before exposing the PCD layer 12. The ring 18 can be formed *in situ* or, alternatively, can be formed as a separate ring component which is attached to the tool insert. The ring 18 may be attached to the tool insert, which has been machined to accept the ring, for example by brazing, press fitting, shrink fitting, or any other convenient method.

The ring 18 includes a cutting edge 20 for cutting through a first substrate such as the steel casing or lining used in a subterranean drilling operation. The PCD layer 12 includes a cutting edge 22 for cutting through a second substrate such as bedrock. In this arrangement, the tungsten carbide of the substrate 10 and the ring 16 is selected for its properties in forming the PCD layer 12 whilst the ring 18 is selected so as to optimize the drilling, milling or cutting through the relevant first substrate. Although the annular

ring 16 of tungsten carbide acts as a further protective layer for the cutting edge 22 of the PCD layer 12, its primary function is to optimize the formation of the PCD layer 12 in a conventional high pressure/high temperature process. Accordingly, in appropriate circumstances, it may be dispensed with, as shown in the embodiment of figure 3, in which like components carry like numerals for convenience. In this embodiment, the cutting edge 20 is used for cutting through a first substrate, whereafter the cutting edge 22 is exposed, without the ring 16 first having to be removed, for cutting through a second substrate.

In both of the above embodiments, the substrate 10 is machined to form a shelf for receiving the ring 18. In some cases, it may be more convenient to machine the entire substrate 10 to the desired diameter and to attach a ring 18 that covers substantially the outer peripheral surface of the substrate 10.

For convenience, the use of the tool insert will be described with regards to its use in the directional drilling of holes in a subterranean bedrock. It is to be understood, however, that the tool insert may be used in any application where a first substrate, which is not suited for cutting, drilling or milling by a PCD cutter, is to be cut, drilled or milled to expose a second substrate to which the PCD cutter is suited.

Referring to figure 4 a drill assembly 30 consists of a rotary drill string 32 and a rotary drill bit 34, of the drag bit kind in this case.

The drill bit 34 is directed down a passage 36 within a steel tubular casing 38. The steel casing 38 is anchored in a borehole or shaft 40 drilled into a subterranean bedrock 42.

In order for the rotary drill bit 34 to drill a horizontal or angled hole into the bedrock 42 in the region indicated by an 'X', it is necessary for the drill bit 34 to be redirected from a vertical direction of movement to a horizontal or angled direction of movement, along the arrow 44. A deflector 46, which is attached to the casing 38 and which has previously been positioned

adjacent the region 'X', causes the bit 34 to change direction in this manner. The deflector 46 is supported by an anchor 48.

In order to drill through the casing 38, typically cemented tungsten carbide cutters have traditionally been used. Once a window 50 has been milled through the casing 38, the drill bit 34 is withdrawn and replaced with a drill bit having abrasion resistant cutters such as PCD cutters. This time consuming operation is obviated by using tool inserts or cutters of the invention. The protective layer or ring 18 is used to mill through the casing 38, whereafter it and the support ring 16 are quickly consumed to expose the cutting edge 22 of the PCD layer, which is suited to cutting through the subterranean bedrock.

The layer of ultra-hard abrasive material will generally be a layer of PCD, although it may also be PCBN where the second substrate requires it. The layer may also be a layer of diamond produced by chemical vapour deposition, called CVD diamond.

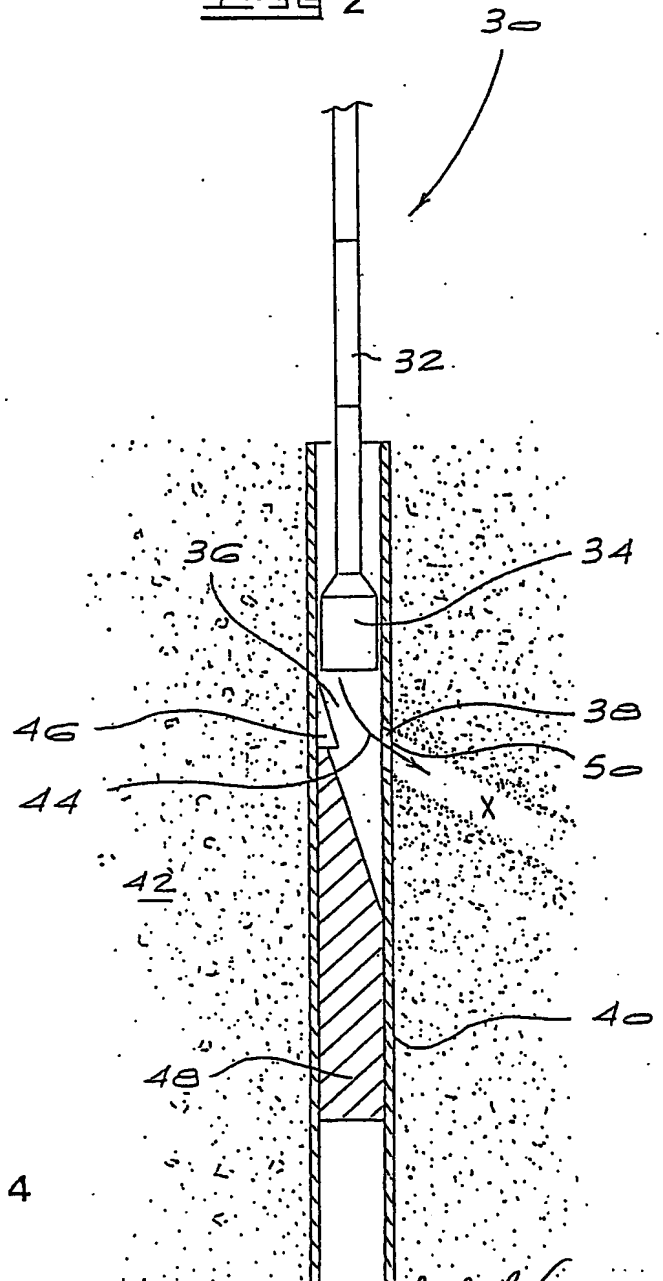
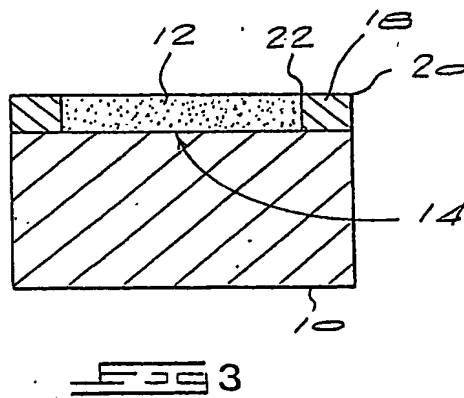
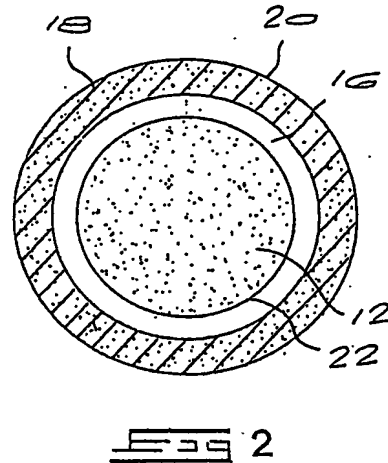
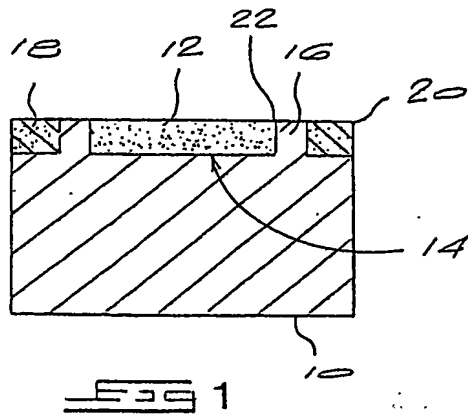
The substrate will generally be a cemented carbide substrate. Such substrates are well known in the art and are generally cemented tungsten carbide substrates.

The tool insert configuration may, where appropriate, be altered or adapted in different applications, provided that the desired purpose, i.e. of protecting the primary cutting edge of a PCD layer whilst milling a window through a first substrate and exposing the PCD cutting edge once a second substrate is encountered, is achieved.

DATED THIS 30th DAY OF OCTOBER 2002



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APPLICANT'S PATENT ATTORNEYS



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Applicant's Patent Attorneys